Localized and distributed guided ultrasonic waves array systems offer an efficient way for the structural health monitoring for large structures. The detection sensitivity for fatigue cracks depends on the orientation of the crack relative to the location of the sensor elements. Crack-like defects have a directionality pattern of the scattered field depending on the angle of the incident wave relative to the defect orientation and on the ratio of the defect depth and length to the wavelength. From FE simulations it has been shown that for cracks and notches almost no energy is scattered in certain directions from the defect, i.e., the data processing algorithm must take into account that for some transducer combinations no change in the signal even for a significant defect will be detected.

The scattered wave field directionality pattern for an incident low frequency $A_0$ Lamb wave mode was predicted from 3D Finite Element simulations and verified from experimental measurements at machined part-through and through-thickness notches using a laser interferometer. Good agreement was found and the directionality pattern can be predicted accurately.

The amplitude of the scattered wave is quantified for a systematic variation of the angle of the incident wave relative to the defect orientation, the defect depth, and the ratio of the characteristic defect size to the wavelength. Based on these results the detection sensitivity for crack-like defects in plate structures using guided wave sensors arrays can be quantified.